

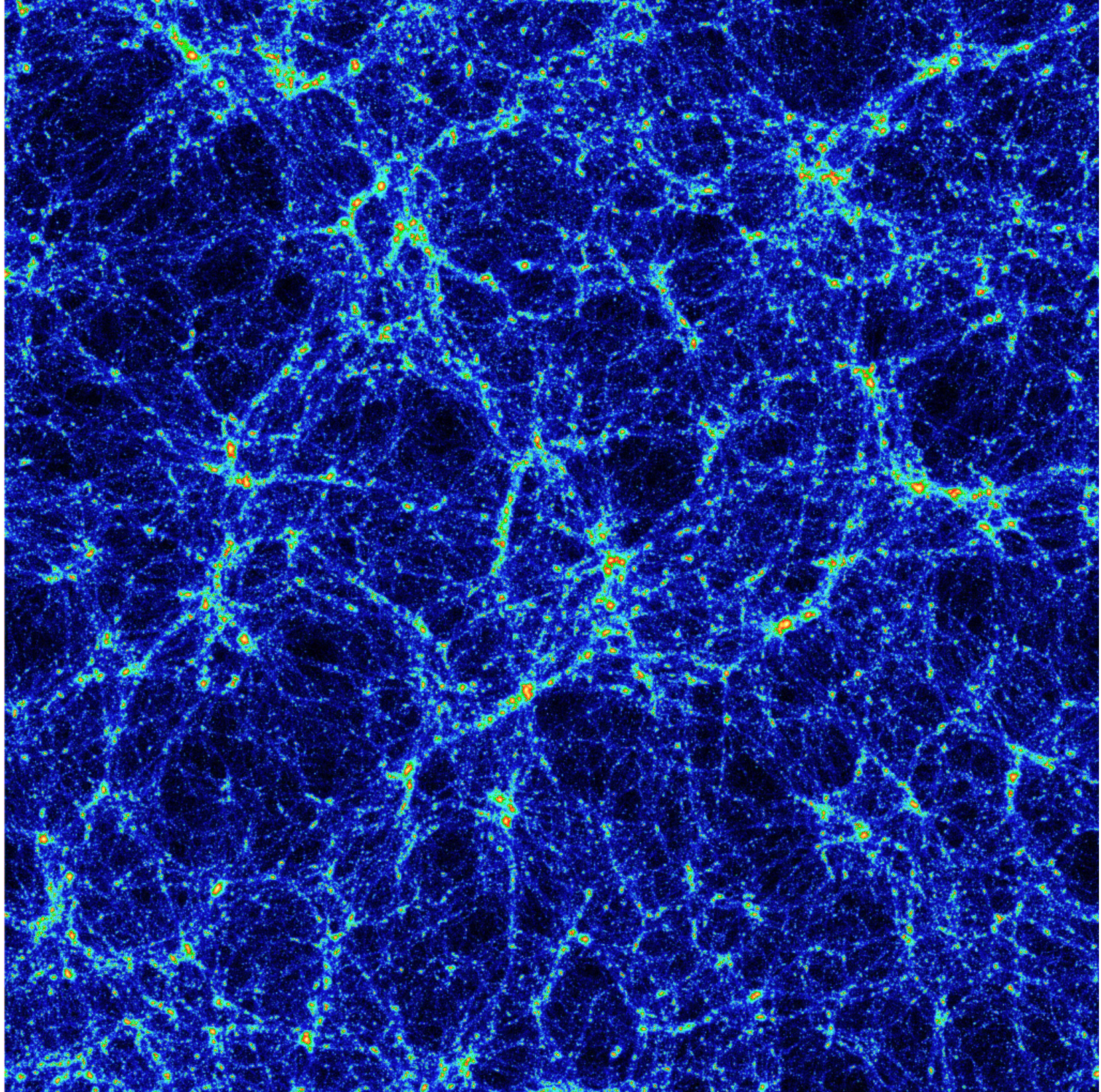
# Halo Bias from N-body Simulations

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# The Hashed Oct-tree Library

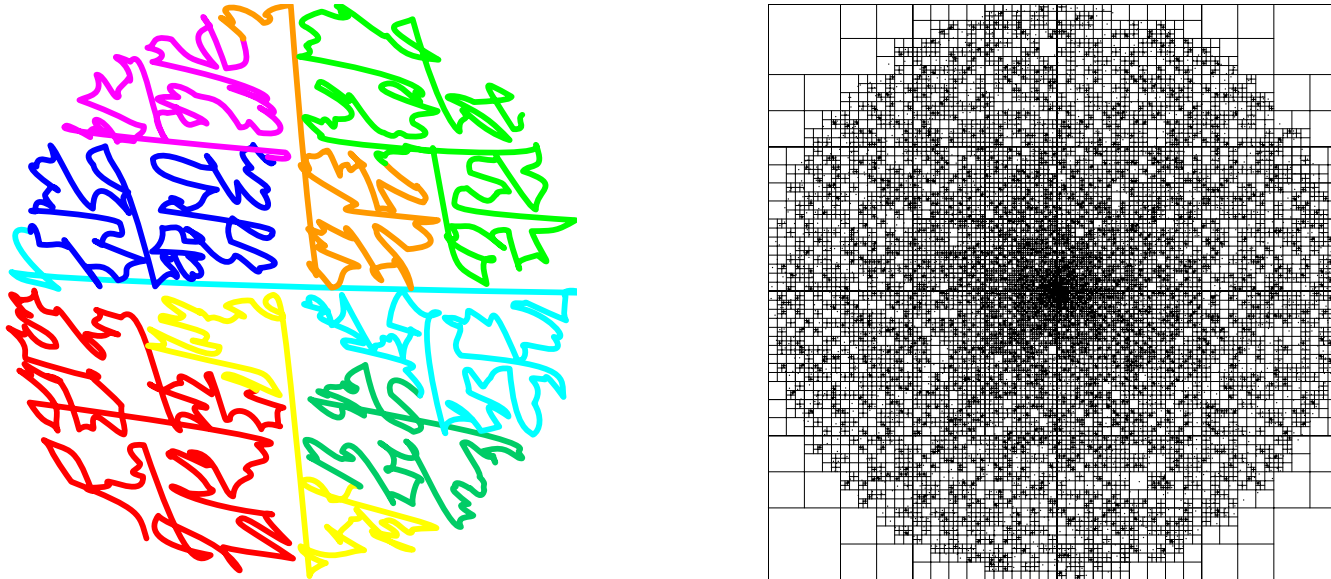


Figure 1: On the left is the self-similar curve used for load-balancing, while the right figure represents a tree data structure in 2d for a group of centrally condensed particles.



# Space Simulator Architecture

Qty.	Price	Ext.	Description
294	280	82,320	Shuttle SS51G mini system (bare)
294	254	74,676	Intel P4/2.53GHz, 533MHz FSB, 512k cache
588	118	69,384	512Mb DDR333 SDRAM (1024Mb per node)
294	95	27,930	3com 3c996B-T Gigabit Ethernet PCI card
294	83	24,402	Maxtor 4K080H4 80Gb 5400rpm Hard Disk
294	35	10,290	Assembly Labor/Extended Warranty
		4,000	Cat6 Ethernet cables
		3,300	Wire shelving/switch rack
		1,378	Power strips
1		186,175	Foundry FastIron 1500+800, 304 Gbit ports
Total		\$483,855	\$1646 per node 5.06 Gflop/s peak/node

Table 1: Space Simulator architecture and price (September, 2002). The total cost per node was \$1646, with \$728 (44%) of that figure representing the Network Interface Cards and Ethernet switches



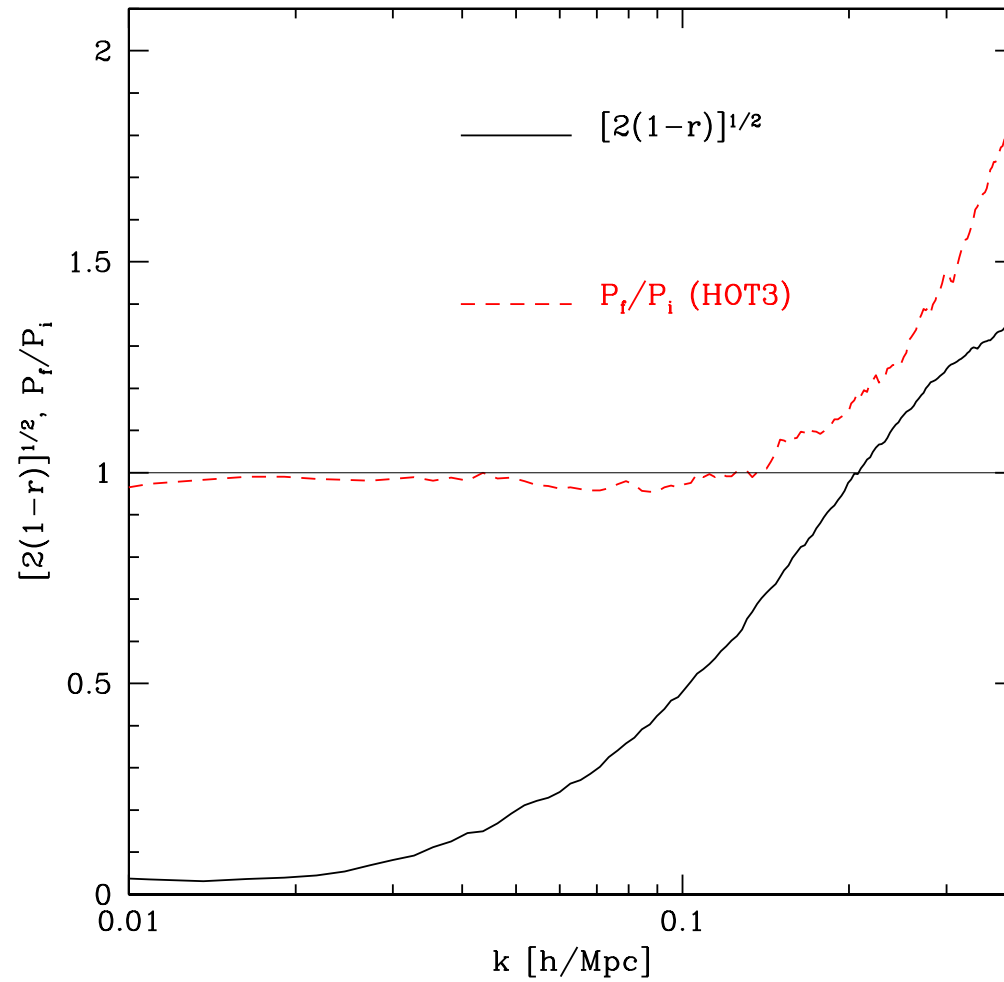
# Historical Performance of the Treecode

Year	Site	Machine	Procs	Gflop/s	Mflops/proc
2003	LANL	Space Simulator (SSE)	288	1166	4050.0
2003	LANL	ASCI QB	3600	2793	775.8
2003	LANL	Space Simulator	288	179.7	623.9
2002	NERSC	IBM SP-3(375/W)	256	57.70	225.0
2002	LANL	Green Destiny	212	38.9	183.5
2000	LANL	SGI Origin 2000	64	13.10	205.0
1998	LANL	Avalon	128	16.16	126.0
1996	LANL	Loki	16	1.28	80.0
1996	SC '96	Loki+Hyglac	32	2.19	68.4
1996	Sandia	ASCI Red	6800	464.9	68.4
1995	JPL	Cray T3D	256	7.94	31.0
1995	LANL	TMC CM-5	512	14.06	27.5
1993	Caltech	Intel Delta	512	10.02	19.6

# Halo Bias

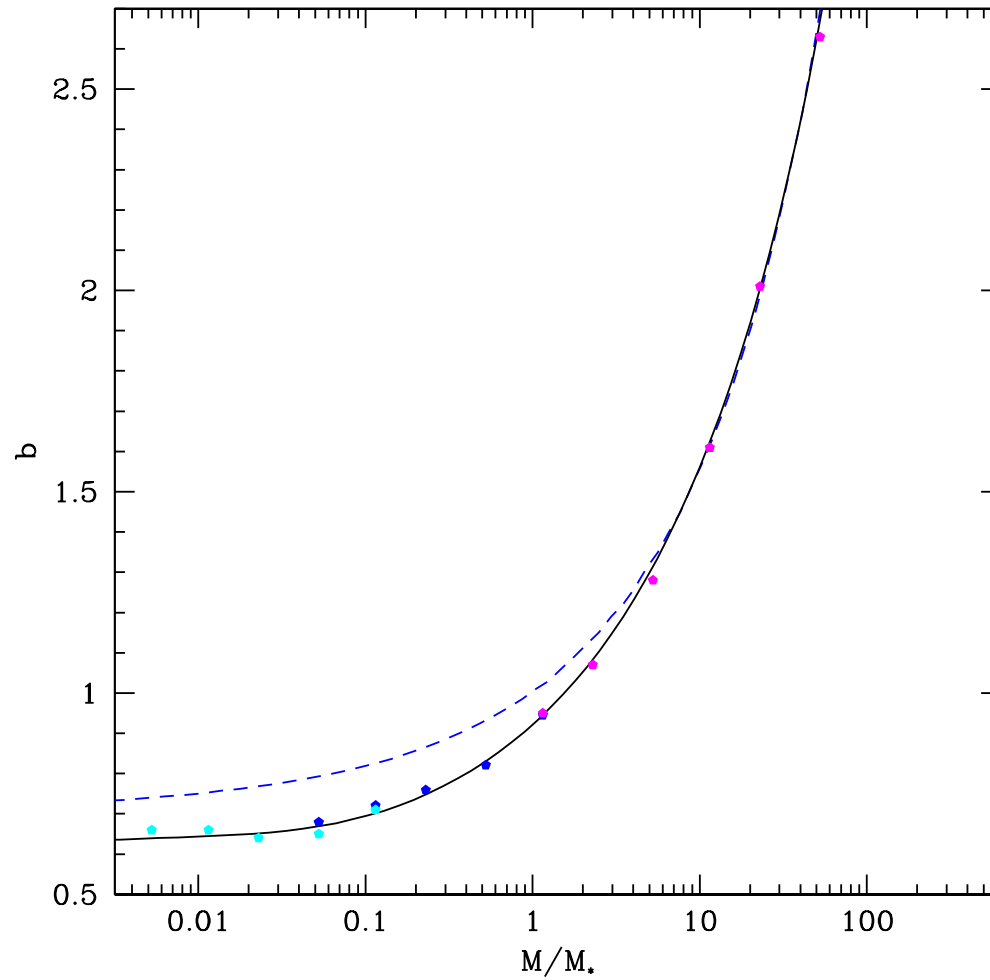
On large scales galaxies and their halos are usually assumed to trace the dark matter with a constant bias and dark matter is assumed to trace the linear density field. We test these assumption using several large N-body simulations with  $384^3 - 768^3$  particles and box sizes of  $96 - 1152h^{-1}\text{Mpc}$ , which can both resolve the small galactic size halos and sample the large scale fluctuations. We explore the average halo bias relation as a function of halo mass and show that existing fitting formulae overestimate the halo bias by up to 20% in the regime just below the nonlinear mass.

# Stochasticity





# Bias as function of halo mass



# Varying the Cosmological Model

